DOCUMENT RESUME

ED 146 009 SE 022 845

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TITLE Calculator Cookery.
INSTITUTION Minneapolis Public Schools, Minn.
PUB DATE [77]
NOTE 110p.; Contains occasional colored pages which may not reproduce well

EDRS PRICE MF-$0.83 HC-$6.01 Plus Postage.
DESCRIPTORS Consumer Education; Curriculum; Elementary Secondary Education; *Instructional Materials; *Learning Activities; Mathematical Applications; Mathematics Education; *Number Concepts; *Secondary School Mathematics; *Teacher Developed Materials; Worksheets
IDENTIFIERS *Calculators

ABSTRACT

This valuable collection of materials was developed to incorporate the calculator as an instructional aid in ninth- and tenth-grade general and basic mathematics classes. The materials are also appropriate for grades 7 and 8. After an introductory section which teaches the use of the calculator, four games and activities are described. For these and subsequent lessons, prior knowledge needed, objectives, materials, and directions are clearly stated. The third set of lessons is on exploring algorithms, with multiplication by tens, hundreds, and thousands considered. Pattern searches comprise several lessons; estimation, calculating in circles, consumer applications, and environmental applications are the focus of remaining sets of lessons. An annotated list of references is also included. All materials are in a form ready to be used by teacher and copied for students. (MS)

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ED146009

CALCULATOR

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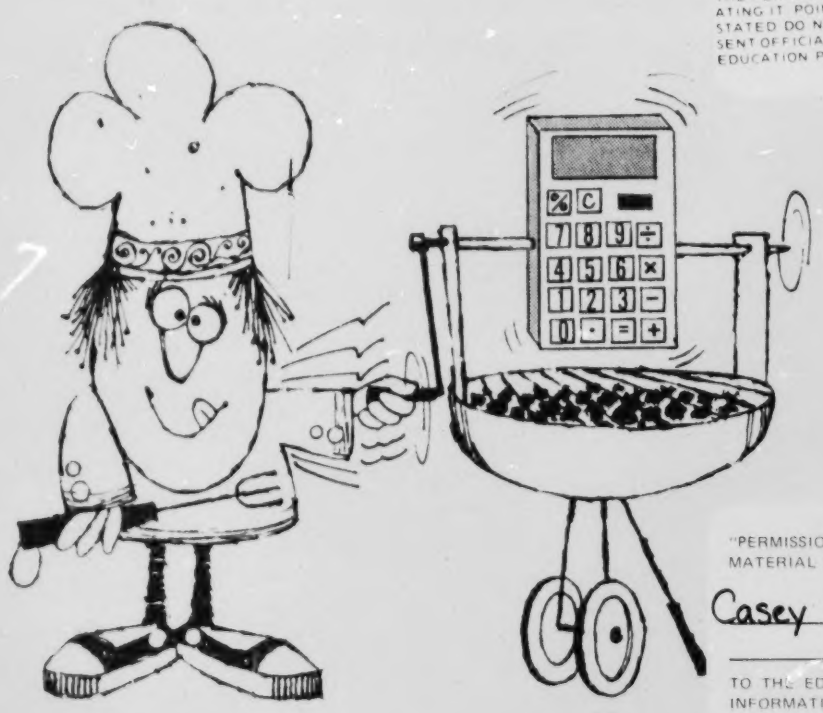

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COOKERY

SE 022 845

INTRODUCTION

The following materials were written by participants in the Mathematics Education Seminar held at the University of Minnesota, Fall Quarter, 1976. The focus of the seminar was on the use of the hand-held calculator as an instructional aid in the ninth and tenth grade general and basic mathematics classes. The materials developed are also appropriate for seventh and eighth grade math classes.

Lessons in each of the categories are presented as examples of the kinds of activities that lend themselves to effective calculator use. Each category represents one of those places in the curriculum where the calculator does do something special.

They are offered for your use and in the hope that they will provide the stimulation for development of other lessons and additional uses of the calculator in your classroom.

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Dick Vevle
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Student Pages

VII. Societal Applications

1. Cigarette Smoking and Your Health 7-1 to 7-4
2. Using The Calculator To Estimate Population 7-5 to 7-12

VIII. Calculator Information Resources
(Annotated Bibliography) 8-1 to 8-8

Table of Contents

	Student Pages
I. Introduction To Your Calculator	
1. Getting To Know Your Calculator	1-1 to 1-4
2. Reading Your Calculator	1-5
3. Guess and Press Signed Numbers	1-6 to 1-7
4. Guess and Press Decimals	1-8 to 1-10
5. Guess and Press ....and Press Again	1-11 to 1-16
II. Games and Activities	
1. Twenty-One	2-1
2. Even and Odd	2-2
3. The Big One	2-3
4. Target K	2-4
III. Exploring Algorithms	
1. Multiplying Whole Numbers by 10, 100, 1000	3-1 to 3-2
2. Multiplying Decimals by 10, 100, 1000	3-3 to 3-5
IV. Pattern Search	
1. Pattern Search	4-1 to 4-2
2. Pattern Within A Pattern	4-3 to 4-6
V. Estimation and Reinforcement of Basic Computation	
1. Estimation and Your Calculator	5-1
2. Calculating in Circles	5-2 to 5-4
VI. Consumer Applications	
1. Calculating an Oil Change	6-1 to 6-3
2. The Calculator and McDonalds	6-4 to 6-8

Teacher Notes for Getting To Know Your Calculator

PRIOR KNOWLEDGE NEEDED: None

OBJECTIVES: Given a calculator the child will be able to:

(1) Turn the calculator on and off.

(2) Enter a number $\leq$ 8 digits.

(3) Understand what happens when a number > 8 digits is entered (overflow).

(4) Use the C/CE (clear / clear entry) key to begin a calculation.

(5) Use the **C/CE** key to correct a number entered.

(6) Use the [+] , [−] , [×] , [÷] , and [=] keys with whole numbers.

(7) Perform operations with the constant function in addition and multiplication.

(8) Solve problems with more than one operation.

(9) Enter a number containing a decimal point.

(10) Use the [+] , [−] , [×] , [÷] , and [=] keys with decimals.

(11) Obtain a negative number in a calculation.

(12) Enter a negative number.

MATERIALS:

(1) A calculator for each child.

(2) Student pages 1-1 to 1-4 duplicated for each child.

This activity is designed to familiarize the students with several basic capabilities of a calculator. PLEASE work through the lesson with your calculator before using it with students.

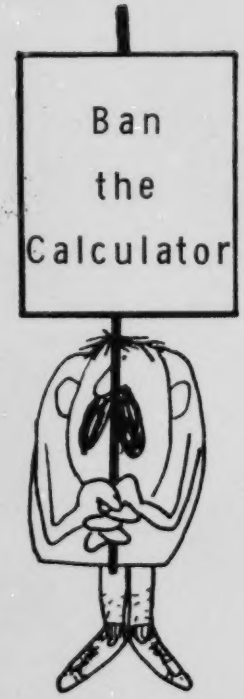
It is important that students guess first, then push the buttons to see what the calculator does. Accuracy in button pushing is improved if students have an estimate of the display in mind.

The lesson may be shortened by using the stop signs as cut off points. The stop signs (after question 11, 32, 46) indicate points where a new calculator function has been introduced. You might let students explore and experiment with what they have discovered. (Especially if this is the first time they have touched a calculator !!)

Getting to Know Your Calculator

1-1

PUSH THESE KEYS	WHAT YOU GUESS WILL APPEAR	WHAT YOU SEE APPEAR
(1) ON		
(2) C 3 2 7 5		
(3) C 1 1 1 1 1 1 1 1 1		
(4) C 1 1 1 1 1 1 1 1 1 1		
(5) C		
(6) C		
(7) 2 2 2 2 2 2 2 2 2		
(8) C C		
(9) 3 + 4		
(10) =		
(11) C 8 - 2 = STOP		



1-2

PUSH THESE KEYS	WHAT YOU GUESS WILL APPEAR	WHAT YOU SEE APPEAR
(12) C 6 + 2 +		
(13) C 6 + 2 + 5 =		
(14) C 6 + 4 C 3 =		
(15) C 6 + 4 C C 3 =		
(16) C 4 + + +		
(17) C 4 = = =		
(18) C 4 + 4 =		
(19) =		
(20) =		
(21) C 4 × 2 =		
(22) C 4 × 3 × 2 =		

1-3

	PUSH THESE KEYS	WHAT YOU GUESS WILL APPEAR	WHAT YOU SEE APPEAR
(23)	C 3 × 2 =		
(24)	=		
(25)	=		
(26)	C 3 × 3 =		
(27)	=		
(28)	=		
(29)	=		
(30)	C 2 4 ÷ 6 =		
(31)	C 6 ÷ 2 4 =		
(32)	C 5 + 4 - 3 = STOP		

1-4

	PUSH THESE KEYS	WHAT YOU GUESS WILL APPEAR	WHAT YOU SEE APPEAR
(33)	C 1 0 - 3 =		
(34)	+ 8 =		
(35)	× 2 =		
(36)	÷ 5 =		
(37)	C 1 0 - 3 + 8 × 2 ÷ 5 =		
(38)	C 1 . 1 3		
(39)	C 3 . 5 + . 7 =		
(40)	6 0 × . 4 =		
(41)	C 6 × . 4 =		
(42)	C 2 - 3 =		
(43)	C - 2 3		
(44)	=		
(45)	C 3 3 6 1 7 7 0 6 4		

(TURN YOUR CALCULATOR UPSIDE DOWN AND READ.)

(46) OFF

Teacher Notes for Reading Your Calculator

PREREQUISITE KNOWLEDGE: None

OBJECTIVES: Given a calculator the child will be able to:

(1) Enter correctly a number $\leq$ 8 digits.

(2) Enter correctly a series of numbers and operation signs.

MATERIALS:

(1) A calculator for each child.

(2) Student page 1-5 duplicated for each student.

This activity will give the students a chance to practice entering numbers into the calculators. By turning the calculators upside down and reading the words the digits spell, the students can judge for themselves if they have entered the numbers correctly.

Reading Your Calculator

(1) What is the firs. thing your calculator would say if it could talk?

PRESS: [.] [7] [7] [3] [4]

for the answer. Now read the calculator upside down. Press [C]

(2) What do small puppies like to dig in the garden?

PRESS: [5] [3] [7] [0] [4]

for the answer. Now read the calculator upside down. PRESS [C]

(3) What's round on both ends and high in the center?

PRESS: [.] [1] [4] [0]

for the answer. Now read the calculator upside down. PRESS [C]

(4) What did the Little Green Sprout say when he saw the Jolly Green Giant?

PRESS: [9] [1] [8] [5] [1] [3] [4]

for the answer. Now read the calculator upside down. PRESS [C]

(5) What did the hamburger say to the onion while sitting on the griddle?

PRESS: [3] [7] [2] [2] [1] [5] [.] [1]

for the answer. Now read the calculator upside down. PRESS [C]

(6) What is the name of a large oil company?

PRESS: [1] [4] [2] [1] [5] [4] [6] [9] [x] [5] [=]

for the answer. Now read the calculator upside down. PRESS [C]

(7) The Grand Canyon is a _____

PRESS: [2] [0] [0] [0] [0] [0] [x] [7] [4] [.] [0] [9] [+]
[4] [7] [2] [x] [.] [0] [0] [0] [2] [5] [=]

for the answer. Now read the calculator upside down.

(8) Make your calculator read the following:

GOOSE _____ hIS SHOES _____

GIGGLE _____ BOBSLED _____

Teacher Notes for Guess and Press Signed Numbers

PRIOR KNOWLEDGE NEEDED: Getting to Know Your Calculator- Student Pages 1-1 to 1-4.
Concepts of Signed Numbers
Add, Subtract, Multiply and Divide Signed Numbers

OBJECTIVES: Given a calculator the child will be able to:

(1) Enter a signed number.

(2) Add any two signed numbers.

(3) Subtract a positive number from a negative number.

(4) Multiply any two signed numbers.

(5) Divide any two signed numbers.

MATERIALS:

(1) A calculator for each child.

(2) Student pages 1-6 and 1-7 duplicated for each child.

This activity will give students practice in using the calculator to perform operations on signed numbers. It is important that the concepts and operations with signed numbers are developed prior to this activity. Point out the problems in the bubbles to the left of each series of buttons on student pages 1-6 and 1-7. These show how problems commonly appear in text materials. Relate each to the "button language" the calculator requires. It is also important that students make guesses first and then press buttons to find the actual display. Calculator users must know that the results of their button pressing are reasonable and know when to check the buttons pressed. Point out that the calculator automatically gives any number a positive sign. Thus it is omitted in the button pushing sequence. This is especially important in items 13-16 on student page 1-7. **PLEASE take special note of items *17 and *18 on student page 1-7. The calculator this activity was written for did not produce correct results for these two cases in subtracting negative numbers.

Stop signs indicated points where you may wish to stop with the lesson and allow students to explore and experiment with the concepts discovered.

GUESS AND PRESS...SIGNED NUMBERS

ON

		YOUR GUESS	DISPLAY AFTER YOU PRESS
(1)	C 1 0 - 1 2 =		
(2)	C 0 - 5 =		
(3)	C - 6		
(4)	C - 6 =		
(5)	C - 2 5		
(6)	C - 2 5 =		

		YOUR ESTIMATED ANSWERS	ACTUAL DISPLAY
$^{-}2 + {}^{+}3 =$	(7) C - 2 + 3 =		
$^{-}8 + {}^{+}3 =$	(8) C - 8 + 3 =		
$^{-}2 + {}^{+}9 =$	(9) C - 2 + 9 =		
$^{-}10 + {}^{+}6 =$	(10) C - 1 0 + 6 =		
$^{-}5 + {}^{-}6 =$	(11) C - 5 + - 6 =		
$^{+}5 + {}^{-}6 =$	(12) C 5 + - 6 =		

STOP

		YOUR ESTIMATED ANSWERS	ACTUAL DISPLAY
$^{-}6 - {}^{+}3 =$	(13) C - 6 - 3 =		
$^{-}10 - {}^{+}8 =$	(14) C - 1 0 - 8 =		
$^{-}6 - {}^{+}9 =$	(15) C - 6 - 9 =		
$^{-}3 - {}^{+}6 =$	(16) C - 3 - 6 =		
$^{+}10 - {}^{-}8 =$	*(17) C 1 0 - - 8 =		
$^{-}10 - {}^{-}8 =$	*(18) C - 1 0 - - 8 =		
$^{-}2 \times {}^{+}3 =$	(19) C - 2 x 3 =		
$^{+}3 \times {}^{-}2 =$	(20) C 3 x - 2 =		
$^{-}2 \times {}^{-}3 =$	(21) C - 2 x - 3 =		
$^{-}3 \div {}^{+}3 =$	(22) C - 3 ÷ 3 =		
$^{+}6 \div {}^{-}3 =$	(23) C 6 ÷ - 3 =		
$^{-}3 \div {}^{-}3 =$	(24) C - 3 ÷ - 3 =		

OFF

Teacher Notes for Guess and Press Decimals

PRIOR KNOWLEDGE NEEDED: Concepts of decimals.
Rounding decimals to nearest whole number.
Estimating in addition, subtraction, multiplication and division.

OBJECTIVES: Given a calculator the child will be able to:

(1) Enter a decimal fraction.

(2) Add whole numbers and decimals.

(3) Add two decimals.

(4) Subtract two decimals.

(5) Subtract decimals from whole numbers.

(6) Multiply whole numbers and decimals.

(7) Multiply two decimals.

(8) Divide decimals by whole numbers.

(9) Divide decimals by decimals.

MATERIALS:

(1) A calculator for each child.

(2) Student pages 1-8 to 1-10 duplicated for each child.

This activity will give students practice in using the calculator to perform operations with decimal fractions. The problems in the bubbles to the left of each series of buttons should be pointed out. These show how problems commonly appear in text materials. Relate each to the "button language" needed to solve with a calculator. Students should use these problems when writing down their estimated answers. Students should be encouraged to give "rough estimates" first then press the buttons to see the actual display.

Stop signs indicate points where you may wish to stop with the lesson and allow students to explore and experiment with the concepts discovered.

GUESS AND PRESS...DECIMALS

ON

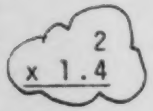
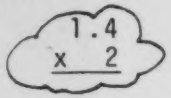
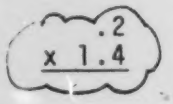
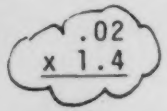
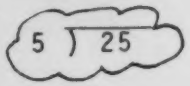
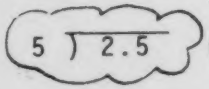
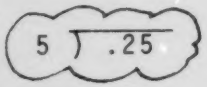
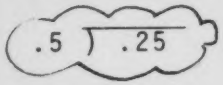
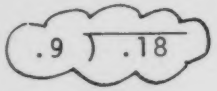
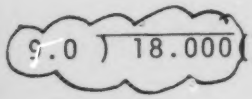
		YOUR GUESS	DISPLAY AFTER YOU PRESS
(1)	C 2 4 5 =		
(2)	C 2 . 4 5 =		
(3)	C 2 4 . 5 =		
(4)	C 2 4 5 . =		
(5)	C 8 . 0 0 1 =		
(6)	C 8 . 1 0 0 =		
(7)	C 8 . 0 0 0 0 0 =		
(8)	C . 0 0 0 5 =		

		YOUR ESTIMATED ANSWERS	ACTUAL DISPLAY
23. + .23	(9) C 2 3 + . 2 3 =		
.45 + 45.	(10) C . 4 5 + 4 5 =		
5.3 + 2.5	(11) C 5 . 3 + 2 . 5 =		
.38 + 1.9	(12) C . 3 8 + 1 . 9 =		

STOP

		YOUR ESTIMATED ANSWERS	ACTUAL DISPLAY
7.8 - 2.3	(13) C 7 . 8 - 2 . 3 =		
8.4 - 2.8	(14) C 8 . 4 - 2 . 8 =		
7.8 - 2.34	(15) C 7 . 8 - 2 . 3 4 =		
8.4 - 2.88	(16) C 8 . 4 - 2 . 8 8 =		
3.76 - 1.76	(17) C 3 . 7 6 - 1 . 7 6 =		
5. - 3.2	(18) C 5 - 3 . 2 =		
5. - 3.02	(19) C 5 - 3 . 0 2 =		
5. - .002	(20) C 5 - . 0 0 2 =		

STOP

		YOUR ESTIMATED ANSWERS	ACTUAL DISPLAY
	(21) C 2 x 1 . 4 =		
	(22) C 1 . 4 x 2 =		
	(23) C . 2 x 1 . 4 =		
	(24) C . 0 2 x 1 . 4 =		
	(25) C 2 5 ÷ 5 =		
	(26) C 2 . 5 ÷ 5 =		
	(27) C . 2 5 ÷ 5 =		
	(28) C . 2 5 ÷ . 5 =		
	(29) C . 1 8 ÷ . 9 =		
	(30) C 1 8 . 0 0 0 ÷ 9 . 0 =		

OFF

Teacher Notes for Guess and Press... and Press Again

PRIOR KNOWLEDGE NEEDED: Decimals
Powers
Percent

OBJECTIVES: Given a calculator the child will be able to:

(1) Correct errors when pushing the [+], [-], [÷], [x] keys.

(2) Add using the constant function.

(3) Multiply using the constant function.

(4) Divide using the constant function.

(5) Generate powers of a number.

(6) See what the [%] key does to a number.

(7) **See** what happens when a number is divided by 0.

MATERIALS:

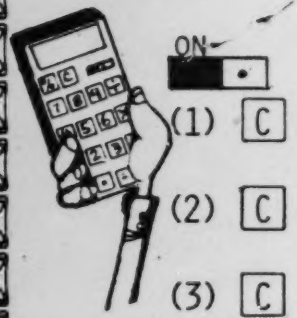
(1) A calculator for each child.

(2) Student pages 1-11 to 1-16 duplicated for each student.

This activity will give the students practice in entering problems in the calculator and testing the capabilities of the calculator. It will also give the students a chance to further explore the constant functions introduced in student pages 1-1 through 1-4. Some interesting discoveries lie within these activities and time to discuss what goes on in the calculator should be provided.

PLEASE work through the pages before using with your students. The functions explored vary with calculators. Stop signs indicate points where you may wish to stop with the lesson and allow students to explore and experiment with the concepts discovered.

GUESS AND PRESS . . . AND PRESS AGAIN



		WHAT YOU GUESS	WHAT YOU PRESS
(1)	C 8 x x 2 =		
(2)	C 8 - - 2 =		
(3)	C 8 ÷ ÷ 2 =		
(4)	C 8 + + 2 =		
(5)	C 1 2 ÷ x 3 =		
(6)	C 1 2 x ÷ 3 =		
(7)	C 1 2 x + 3 =		
(8)	C 1 2 + x 3 =		
(9)	C 1 2 ÷ + 3 =		
(10)	C 1 2 + ÷ 3 =		
(11)	C 1 2 ÷ - x 3 =		
(12)	C 1 2 x - ÷ 3 =		

		WHAT YOU GUESS	WHAT YOU PRESS
(13)	C 1 2 ÷ + x 3 =		
(14)	C 1 2 x + ÷ 3 =		
(15)	C 1 2 x + - ÷ 3 =		
(16)	C 1 2 x - 3 =		
(17)	C 5 . 6 . 7 .		
(18)	C 2 x . x 2 =		
(19)	C 2 + . + 2 =		
(20)	C 2 ÷ . ÷ 2 =		
(21)	C 2 - . - 2 =		
(22)	C 2 - . . . - 2 =		
(23)	C 3 ÷ x - + =		
(24)	C 4 ÷ x + =		

STOP

(25) [C] [8] [=] [=] [=]

(26) [C] [8] [+] [2] [=]

(27) [=]

(28) [=]

(29) [C] [8] [+] [=]

(30) [4] [=]

(31) [5] [=]

(32) [C] [8] [+] [2] [=]

(33) [3] [=]

(34) [4] [=]

(35) [5] [=]

STOP

WHAT YOU GUESS	WHAT YOU PRESS

	WHAT YOU GUESS	WHAT YOU PRESS
(36) [C] [8] [-] [2] [=]		
(37) [=]		
(38) [=]		
(39) [=]		
(40) [C] [3] [-] [=]		
(41) [4] [=]		
(42) [5] [=]		
(43) [C] [3] [-] [2] [=]		
(44) [3] [=]		
(45) [4] [=]		
(46) [5] [=]		

	WHAT YOU GUESS	WHAT YOU PRESS
(47) [C] [2] [x] [2] [=]		
(48) [=]		
(49) [=]		
(50) [=]		
(51) [C] [2] [x] [=]		
(52) [=]		
(53) [=]		
(54) [=]		
(55) [C] [2] [x] [=]		
(56) [3] [=]		
(57) [4] [=]		
(58) [5] [=]		

STOP

	WHAT YOU GUESS	WHAT YOU PRESS
(59) [C] [3] [2] [÷] [=] [=] [=]		
(60) [C] [3] [÷] [=]		
(61) [6] [=]		
(62) [9] [=]		
(63) [1] [2] [=]		
(64) [C] [8] [9] [%]		
(65) [%]		
(66) [%]		
(67) [C] [0] [%]		
(68) [C] [8] [÷] [0] [=]		
(69) [C]		
(70) [C]		

OFF

Teacher Notes for Twenty-One

PRIOR KNOWLEDGE NEEDED:

(1) Add on the calculator.

OBJECTIVES: Given a calculator the child will be able to:

(1) Practice mental addition.

(2) Practice game strategy.

MATERIALS:

(1) 2 players.

(2) 1 calculator.

(3) Numberline page 2-1 for each pair of students.

The object of the game is to force a player to total 21 or more on the calculator. First each player must decide who will play first. The first player pushes the [1], [2] or [3] on the calculator and the [+] key. The next player takes his/her turn by pushing the [1], [2] or [3] key and the [+] key. Players take turns until a player pushes the + key and the display reads 21 or more. If this happens that player loses the game.

To aid in discovering the strategy for winning, have students circle each sum on the numberline (page 2-1) as displayed on the calculator on each player's move. Players may wish to compare numberlines and see if they can devise a rule or pattern for the second person always winning. (Second player makes totals of 4, 8, 12, 16 and 20.)

For a more complicated game, use the keys [1] [2] [3] [4] [5] or [6]. The first person totaling 50 or more loses. This game has a winning strategy for the second player, similar to the strategy for the game above.

2-1

NUMBERLINE FOR TWENTY-ONE

Teacher Notes for Even & Odd

PRIOR KNOWLEDGE NEEDED:

(1) Add, Subtract, Multiply and Divide on the calculator.

(2) Identify odd and even numbers to 100.

OBJECTIVES: Given a calculator the child will be able to:

(1) Practice working with odd and even numbers.

(2) Practice mental calculations.

(3) Develop rules for adding, subtracting, multiplying and dividing even and odd numbers.

MATERIALS:

(1) 2 players

(2) 1 calculator

(3) Numeral Cards 0-9 page 2-2

The object of the game is to reach either an even or odd number as the final number. Each player must first decide to be an even or an odd player and who will play first. The goal of the even player is to make an even number appear on the calculator as the final number. Likewise, the odd player must have an odd number appear as the final number.

Cut up numeral cards page 2-2 and lay out face up. As each number is used by a player, the card is turned over. The first player plays a number. The second player then plays a function and a number. This has taken up two numbers since any number used may never be played again. The players must decide how to use the remaining numbers to reach an even or odd result.

Neither player can multiply or divide by zero. If a number is a decimal fraction, only that part of the number up to tenths place will be used (i.e. 6.56 is odd since only 6.5 is used).

0	1	2	3
4	5	6	7
8	9		

Numeral Cards
for
Even & Odd

Teacher Notes for The Big One

PRIOR KNOWLEDGE NEEDED:

(1) Use of the constant division function on a calculator. (See introduction to the calculator 1-11 through 1-16.)

(2) Division of a whole number by itself.

(3) Division of whole numbers writing quotients as decimals.

OBJECTIVES: Given a calculator the child will be able to:

(1) Estimate the divisor given the quotient and dividend in a division problem.

MATERIALS:

(1) 2 players.

(2) 1 or 2 calculators.

(3) Page 2-3 for each pair of students.

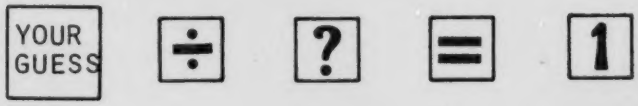
The object of the game is to get the calculator display to read 1. One player selects a mystery number (one, two or three digits). To put the number into the machine, key in the mystery number followed by [÷] [=]. The mystery number is now a constant divisor. Caution - do not clear the machine at any point during the play or the number will be wiped out.

Give the calculator to the other player who will now try to guess the mystery number by keying in the guess followed by [=]. First player should record each number the second player guesses and the calculator display after the [=] is pressed. This record will help prevent the player from repeating a guess as well as develop a pattern for guessing. Students might wish to see who can guess a secret number in the fewest tries.

If the guess is correct, the display will show 1 after the [=] key is pressed. If the number entered is not correct, the display will give clues by showing what the guess divided by the mystery number equals. If the display is >1, the guess was too large. If the display is <1, the guess was too small.

THE BIG ONE

FIRST PLAYER ENTERS



	Guess		Display
1)	_ _ _	=	_ _ _ _ _ _ _ _
2)	_ _ _	=	_ _ _ _ _ _ _ _
3)	_ _ _	=	_ _ _ _ _ _ _ _
4)	_ _ _	=	_ _ _ _ _ _ _ _
5)	_ _ _	=	_ _ _ _ _ _ _ _
6)	_ _ _	=	_ _ _ _ _ _ _ _
7)	_ _ _	=	_ _ _ _ _ _ _ _
8)	_ _ _	=	_ _ _ _ _ _ _ _
9)	_ _ _	=	_ _ _ _ _ _ _ _
10)	_ _ _	=	_ _ _ _ _ _ _ _

Teacher Notes for Target K

PRIOR KNOWLEDGE NEEDED:

(1) Multiply whole numbers by decimal numbers.

(2) Estimate in multiplication.

(3) Multiply using the constant function on a calculator. (See introduction to the calculator pages 1-11 through 1-16.)

OBJECTIVES: Given a calcualtor the child will be able to:

(1) Estimate in multiplication of whole numbers and decimals.

MATERIALS:

(1) 2 players.

(2) 1 calculator.

(3) Page 2-4 for each pair of players.

The object of the game is to get the target number on the display using a constant multiplier. The decimal part of the display will not be read.

Choose a target number and a constant multiplier. Enter the constant into the calculator followed by [x] [=]. Caution - do not clear the machine after the constant has been put in, otherwise the constant will disappear. The object of the game is to guess what number, when multiplied by the constant, will give the target number.

Example: If the target number is 500 and the multiplication constant is 17, then key in [17] [x] [=]. Make a guess, say 50 [=] which gives 850 - too large. Make another guess, say 20 = , which gives 340 - too small. The correct answer must be between 20 and 50. When students find that 29 [=] is too small and 30 [=] is too large, they will begin trying decimals. The decimal part of the display will not be read. If the target is 500 and the display reads 500.416, this would win the game.

Target K

Complete: Guess [X] [*Constant] [=] [Target]

Enter: [*Constant] [X] [=]

PLAYER 1		PLAYER 2	
Guess	Display	Guess	Display
1.	=	1.	=
2.	=	2.	=
3.	=	3.	=
4.	=	4.	=
5.	=	5.	=
6.	=	6.	=
7.	=	7.	=
8.	=	8.	=
9.	=	9.	=
10.	=	10.	=
11.	=	11.	=
12.	=	12.	=
13.	=	13.	=
14.	=	14.	=
15.	=	15.	=

Teacher Notes for Multiplying Whole Numbers by 10, 100, 1000

PREREQUISITE KNOWLEDGE:

1. Multiply on a calculator

OBJECTIVES: Given a calcualtor a child will be able to:

1. discover a rule for multiplying whole numbers by 10, 100, 1000.

MATERIALS:

1. Calculator for each child
2. Student Pages 3-1, 3-2 duplicated for each child.

Alone or in small groups have students work on page 3-1. Before going on to the next page compare results in a large group. Have them share now they would explain to a friend an easy way to multiply by 10.

Let the students go on their own to do page 3-2. Once again compare results in a large group. Share among each other the rules they wrote down for multiplying whole numbers by 10, 100, 1000.

Multiplying Whole Numbers by 10, 100, 1000

Use your calculator to find each product.

10 x 10 = _____	20 x 10 = _____
11 x 10 = _____	21 x 10 = _____
12 x 10 = _____	22 x 10 = _____
13 x 10 = _____	23 x 10 = _____
14 x 10 = _____	24 x 10 = _____
15 x 10 = _____	25 x 10 = _____

Look closely at the first factor in each problem and the answer. Now without using your calculator answer each problem.

30 x 10 = _____
31 x 10 = _____
32 x 10 = _____
33 x 10 = _____
34 x 10 = _____
35 x 10 = _____

Check with your calculator. Were you correct ?
How could you explain to a friend an easy way to multiply a number by 10 ?

_____

Will this work for other whole numbers ?

	Guess	Actual Display
156 x 10 =	_____	_____
4,789 x 10 =	_____	_____
34,768 x 10 =	_____	_____

More Multiplying by 10, 100, 1000

Use your calculator to find each product.

10 x 100 = _____	20 x 1000 = _____
11 x 100 = _____	21 x 1000 = _____
12 x 100 = _____	22 x 1000 = _____
13 x 100 = _____	23 x 1000 = _____
14 x 100 = _____	24 x 1000 = _____
15 x 100 = _____	25 x 1000 = _____

Look closely at the first factor in each problem and the answer.
Now without using your calculator answer each problem.

30 x 100 = _____
31 x 100 = _____
32 x 100 = _____
33 x 1000 = _____
34 x 1000 = _____
35 x 1000 = _____

Check with your calculator. Were you correct ?
Can you write a rule for multiplying whole numbers by 10, 100, 1000 ?

_____

Use your rule to predict the answer to each problem. Check with your calculator.

	Guess	Actual Display
472 x 100 =	_____	_____
1,976 x 1000 =	_____	_____

Can you guess ? 15 x 10,000 = _____

Teacher Notes for Multiplying Decimals by 10, 100, 1000

PREREQUISITE KNOWLEDGE:

1. Enter decimals on calculator
2. Multiply on a calculator

OBJECTIVES: Given a calculator a child will be able to:

1. Discover a rule for multiplying a decimal by 10, 100, 1000.

MATERIALS:

1. Calculator for each student
2. Student Pages 3-3, 3-4, 3-5 duplicated for each child.

This activity should follow multiplying whole numbers by 10, 100, 1000. Have the students do page 3-3 alone or in small groups and then compare results in a large group. On page 3-3, they should discover that a quick way to multiply a decimal by 10 is to move the decimal point 1 place to the right. Talk about why that is so.

On page 3-4, children again can work independently but come together as a large group to compare rules. They should discover that to multiply a decimal by 100, move decimal point 2 places to the right; for 1000, move decimal point 3 places to the right. If they see this, try to generalize a rule for 10^n.

For page 3-5, you are trying to combine rules for multiplying decimals and whole numbers by 10, 100, 1000. Once a final rule is written, make a large sign and post it in the classroom.

Multiplying Decimals by 10, 100, 1000

Use your calculator to find each product.

23.6 x 10 = _____	.427 x 10 = _____	9.36 x 10 = _____
2.36 x 10 = _____	4.27 x 10 = _____	.936 x 10 = _____
.236 x 10 = _____	42.7 x 10 = _____	93.6 x 10 = _____

Look closely at the first factor in each problem and the answer.
What happened to the decimal point ? _____

Now without using your calculator answer each problem.

53.6 x 10 = _____	.701 x 10 = _____
5.36 x 10 = _____	7.01 x 10 = _____
.536 x 10 = _____	70.1 x 10 = _____
.0536 x 10 = _____	701.0 x 10 = _____

Check with your calculator. Were you correct ?
Write a rule for multiplying decimals by 10.

_____

_____

Will your rule work for other decimal ?

	Guess	Actual Display
63.472 x 10 =	_____	_____
.9372 x 10 =	_____	_____
3473.6 x 10 =	_____	_____
.00785 x 10 =	_____	_____
34.56 x 10 =	_____	_____ _____

More Multiplying Decimals

Use your calculator to find each product.

57.232 x 100 = _____	.837242 x 1000 = _____
5.7232 x 100 = _____	8.37242 x 1000 = _____
.57232 x 100 = _____	83.7242 x 1000 = _____

Look closely at the first factor in each problem and the answer.
What happened to the decimal point ?_____

Now without using your calculator answer each problem.

47.36 x 100 = _____	.37241 x 1000 = _____
4.736 x 100 = _____	3.7241 x 1000 = _____
.4736 x 100 = _____	37.241 x 1000 = _____
.04736 x 100 = _____	37 2.41 x 1000 = _____

Check with your calculator. Were you correct ?
Write a rule for multiplying decimals by 10, 100, 1000.

_____

_____

Will your rule work for other decimals ?

	Guess	Actual Display
3.762 x 100 =	_____	_____
14.83 x 10 =	_____	_____
.372 x 100 =	_____	_____
.5643 x 1000=	_____	_____

Guess this product: .37642 x 10,000 = _____

Multiplying Whole Numbers & Decimals by 10, 100, 1000

Can your rule for multiplying decimals by 10, 100, 1000 also be used for multiplying whole numbers by 10, 100, 1000 ?

How could you use your decimal rule to explain:

363 x 100 = 36300

(hint: where is the decimal point in 363?)

Use your calculator to find each product.

37.2 x 100 = _____

46.37 x 1000 = _____

.8 x 1000 = _____

36.7 x 100 = _____

Can you write a new rule that would explain to a friend how to multiply any decimal or whole number by 10, 100, 1000....

Use your new rule to find each product. Check with your calculator.

476 x 10 = _____

.37 x 1000 = _____

19.06 x 100 = _____

15. x 1000 = _____

6.072 x 100 = _____

Teacher Notes for Pattern Search

PREREQUISITE KNOWLEDGE:

1. Multiply on a calculator

OBJECTIVES: Given a calculator a child will be able to:

1. Use the calculator to discover patterns developed by multiplying by 111 and 111,111.
2. Use the associative property of multiplication.

MATERIALS:

1. A calculator for each student.
2. Student Pages 4-1, 4-2 duplicated for each student.

This activity on page 4-1 should precede Pattern Within A Pattern. Students use the calculator to multiply 37 by multiples of 3. After the first few problems, the student should be able to accurately predict the remaining problems. Have them guess and then use the calculator to verify their predictions. The bottom of the page requires the students to look closely at why pattern works. Note that 37 x 3 = 111.

Each problem can be rewritten using the associative property to show that 37 x 3 is included in each problem. The answers then become obvious (111 x 2, 111 x 3, 111 x 4).

Page 4-2 extends this pattern. Since 37037 x 3 = 111,111 all problems can be rewritten as 111,111 x 2, x 3, x 4, . . . Let students work with other students, to discover the patterns on their own. As a large group you can compare results.

Pattern Search

Multiply	Guess	Product
37 x 3 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 6 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 9 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 12 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 15 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 18 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 21 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 24 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _
37 x 27 =	_ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _

Is there a quick way to determine what 37 x 27 = if you only know what 37 x 3 = ?

Rewrite each problem to show your discovery.

37 x 6 = (37 x 3) x 2 = 111 x 2 = 222

37 x 9 = _____ = _____ = _____

37 x 12 = _____ = _____ = _____

37 x 15 = _____ = _____ = _____

37 x 18 = _____ = _____ = _____

extend the pattern...

Multiply	Product
37037 x 3 =	_ _ _ _ _ _ _ _ _
37037 x 6 =	_ _ _ _ _ _ _ _ _
37037 x 9 =	_ _ _ _ _ _ _ _ _
37037 x 12 =	_ _ _ _ _ _ _ _ _
Without using your calculator .....predict the rest.	
37037 x 15 =	_ _ _ _ _ _ _ _ _
37037 x 18 =	_ _ _ _ _ _ _ _ _
37037 x 21 =	_ _ _ _ _ _ _ _ _
37037 x 24 =	_ _ _ _ _ _ _ _ _
37037 x 27 =	_ _ _ _ _ _ _ _ _

Is there a quick way to determine what 37037 x 21= if you only know what 37037 x 3 = ?

Rewrite each problem to show your discovery.

37037 x 9 = _____ = _____ = _____

37037 x 12 = _____ = _____ = _____

37037 x 15 = _____ = _____ = _____

37037 x 18 = _____ = _____ = _____

37037 x 21 = _____ = _____ = _____

Teacher Notes for Pattern Within A Pattern

PREREQUISITE KNOWLEDGE:

1. Multiply on a calculator.

OBJECTIVES: Given a calculator the child will be able to:

1. Use the calculator to discover patterns when multiplying 1, 2, 3 ... 60 by 111.

MATERIALS:

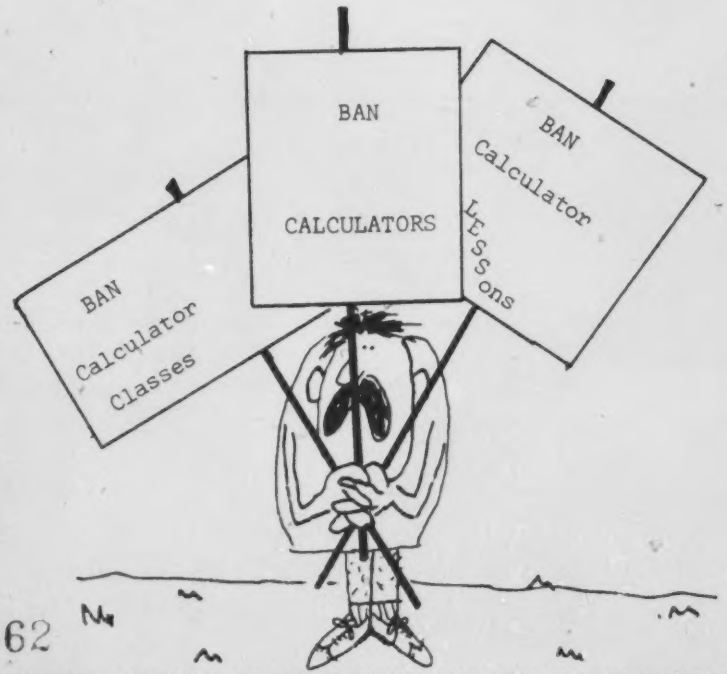
1. Calculator for each child.
2. Student pages 4-3 to 4-6 duplicated for each student.

The pattern is developed by multiplying numbers ≤ 60 by 111. Have the children work through pages 4-3 to 4-6, following the directions on each page. There are many patterns on these pages. Encourage your students to find as many as they can. Have them look closely for patterns in the one's place, ten's place, etc.

Do this activity before assigning it to your class. See what patterns you can find.

$37 \times (1...60) \times 3 = ?$

Pattern Within a Pattern



A

Multiply on the Calculator	Product
37 x 1 x 3 =	
37 x 2 x 3 =	
37 x 3 x 3 =	
Without using your calculator . . . 37 x 4 x 3 =	predict the rest.
37 x 5 x 3 =	
37 x 6 x 3 =	
37 x 7 x 3 =	
37 x 8 x 3 =	
37 x 9 x 3 =	
37 x 10 x 3 =	

Check each prediction with your calculator.
Circle the prediction(s) that didn't follow the pattern.

Multiply on the Calculator	Product
37 x 11 x 3 =	
37 x 12 x 3 =	
37 x 13 x 3 =	
Without using your calculator . . .	predict the rest.
37 x 14 x 3 =	
37 x 15 x 3 =	
37 x 16 x 3 =	
37 x 17 x 3 =	
37 x 18 x 3 =	
37 x 19 x 3 =	
37 x 20 x 3 =	

Check each prediction with your calculator.
Circle the prediction(s) that didn't follow the pattern.

Multiply on the Calculator	Product
37 x 21 x 3 =	
37 x 22 x 3 =	
37 x 23 x 3 =	
Without using your calculator . . .	predict the rest.
37 x 24 x 3 =	
37 x 25 x 3 =	
37 x 26 x 3 =	
37 x 27 x 3 =	
37 x 28 x 3 =	
37 x 29 x 3 =	
37 x 30 x 3 =	

Check each prediction with your calculator.
Circle the prediction(s) that didn't follow the pattern.

D

Multiply on the Calculator	Product
37 x 31 x 3 =	
37 x 32 x 3 =	
37 x 33 x 3 =	
Without using your calculator . . . 37 x 34 x 3 =	predict the rest.
37 x 35 x 3 =	
37 x 36 x 3 =	
37 x 37 x 3 =	
37 x 38 x 3 =	
37 x 39 x 3 =	
37 x 40 x 3 =	

Check each prediction with your calculator.
Circle the prediction(s) that didn't fit the pattern.

E

Multiply on the Calculator	Product
37 x 41 x 3 =	
37 x 42 x 3 =	
37 x 43 x 3 =	
Without using your calculator . . . 37 x 44 x 3 =	predict the rest.
37 x 45 x 3 =	
37 x 46 x 3 =	
37 x 47 x 3 =	
37 x 48 x 3 =	
37 x 49 x 3 =	
37 x 50 x 3 =	

Check each prediction with your calculator.
Circle those that don't follow the pattern. Look at cards A, B, C and D. Is there a pattern in the numbers that are circled?

F

Multiply on the Calculator	Product
37 x 51 x 3 =	
37 x 52 x 3 =	
37 x 53 x 3 =	
Without using your calculator . . . predict the rest.	
37 x 54 x 3 =	
37 x 55 x 3 =	
37 x 56 x 3 =	
37 x 57 x 3 =	
37 x 58 x 3 =	
37 x 59 x 3 =	
37 x 60 x 3 =	

Check each prediction with your calculator. Look at cards A, B, C, D, E and F. How many patterns do you see? Without using a calculator can you predict for 61 - 70? 71 - 80?

Teacher Notes for Estimation and Your Calculator

Prerequisite Knowledge:

(1) Round whole numbers to nearest 10, 100

(2) Round decimals to nearest whole number

(3) Estimate sums

Objectives: Given a calculator the child will be able to:

(1) Use estimation skill to decide on reasonableness of answers to addition problems solved on a calculator.

Materials

(1) A calculator for each student

(2) Student Page 5-1

Even though children will have the ability to solve problems rapidly with the calculator, answers will be wrong if they enter the numbers incorrectly. Children will need to be able to judge if the answers the calculators give them are reasonable. Estimating skills are as important as being able to enter numbers on a calculator. This exercise will give students a chance to practice this estimation skill. Make other sheets like this for subtraction, multiplication and division.

Estimation and Your Calculator

Denny did the following problems on his calculator. He wasn't very careful and incorrectly entered some of the numbers. Look carefully at each problem, estimating each sum. Circle all problems you think are wrong. Go back to each problem and find the correct answer using your calculator.

6.8	32.7	2.57
4.21	831	36.9
38.26	7426	103.472
+ 14.26	+ 0.92	+ .3
63.53	8676.9	143.242

23.44 + 7.62 + 894 + 18 = 943.06

0.349 + 8.621 + 0.4 + 50 = 14.37

134 + 826 + 931 +45 = 1936

105 + 1592 + 200 = 3.78 = 2275

7.24 + 9.81 + 6.31 + 3.33 = 773.12

Teacher Notes for Calculating in Circles

PRIOR KNOWLEDGE NEEDED:

(1) Add, subtract, multiply and divide on the calculator.

(2) Measure lengths to the nearest millimetre.

OBJECTIVES: Given a calculator the child will be able to:

(1) Discover the relationship between the circumference and the diameter of a circle and identify this relationship as Pi.

(2) Find the circumference of any circle given the diameter.

MATERIALS:

(1) A calculator for each child.

(2) 4 circles of different sizes.

(3) string

(4) centimetre ruler

(5) Pages 5-2, 5-3, 5-4 duplicated for each child or group of children.

One way to organize this activity would be to reproduce pages 5-2, 5-3, 5-4 on index to form activity cards. Collect the other materials (string, ruler, paper, circles) and put them in a shoe box or coffee can. Assign this activity to a small group of children to work on independently. Several groups could be doing this activity at the same time, coming together as a large group to compare findings.

card 1

Calculating in Circles

You need: 4 circles of different sizes labeled A, B, C, D
string, centimetre ruler, calculator

Using everything you gathered, make and complete a table like the one below.

Circle	radius	diameter	circum-ference	C+D	CxD	C-D	C÷D
A							
B							
C							
D							

Try to find a relationship between circumference and diameter that seems to be true for every circle.

card 2

If you had a circle with a diameter of 100 cm, what would you predict C ÷ D would equal ?

A special name for this relationship: C ÷ D is pi (π).

Find out what you can about pi. Look in different math books.
Can pi be measured exactly ?
Can our measures of circles be exact ?

card 3

3.14159265358979323846264338327950288419716939937510.....

If: 1) you know the diameter of a circle

2) you know that for any circle $C \div D = \pi$

then how could you find the circumference of that circle ?

Write a rule that you can use to find the circumference of any circle .
(turn this card upside down to check your rule with mine)

Using your rule make and complete a table like this one.

My rule for circumference: C = _____

diameter	pi	Circumference
30 cm		
9.2 cm		
55 cm		

$C = D \times \pi$

card 4

Bicycles come in various sizes: 18", 24", 27", 36".
These numbers refer to the diameter of the wheels.
How far does each bike travel when the wheels make 1 complete revolution ?

size	1 revolution	10 revolutions	100 revolutions
18"			
24"			
27"			
36"			

card 5

Pick one of the 4 topics, and gather some information to solve it. A car dealer or a bike dealer might help you. Perhaps you and a friend can figure it out on your own.

1) How does a mileage gauge work on a bicycle ?

2) How does shifting the gears on your bicycle effect how far you travel with 1 revolution of a pedal ?

3) How does the odometer on a car work ?

4) If you put oversize tires on your car, what effect will this have on the accuracy of the odometer ?

Teacher Notes for Calculating an Oil Change

PRIOR KNOWLEDGE NEEDED:

(1) Using Percents
(2) Finding Averages

OBJECTIVES: Given a calculator the student will be able to:

(1) Calculate the total cost of an oil change.
(2) Calculate the savings (or loss) of doing an oil change at home.
(3) Calculate the average cost of an oil change over a two year period.
(4) Calculate the price of an oil change if one intends to make a 30% profit.

MATERIALS:

(1) A calculator for each student.
(2) Student Pages 6-1 to 6-3 duplicated for each student.
(3) The price of an oil change at one or more local service stations.

The class (or teacher) will have to find out the cost of an oil change at a service station. Although it is possible to use the same cost by a service station for every oil change, the students will get a more realistic price if the cost is found for four or eight different places. These can then be used alternately for the different dates. Many service stations advertise a very low price for an oil change (Goodyear $4.88). However, many of these advertised prices do not include the filter. Be sure to ask for the price of the oil change and filter.

The teacher might also discuss with the students what to do with the old oil. Some service stations have places to dump used oil so it can be recycled.

Calculating an Oil Change

You own a '72 Oldsmobile. You are trying to decide if you should change your own oil or have it done at the local service station. Your car's oil and oil filter should be changed every 3000 miles. You drive an average of 12,000 miles each year. The chart below lists the costs of materials needed to change the oil in your car.

Materials Needed for an Oil Change		Cost
TOOLS	Oil Can Spout	$ .59
	Oil Plug Wrench	3.89
	Pan	1.29
	Oil Filter Wrench	1.95
SUPPLIES	One Quart of Oil	.79
	Oil Filter	1.99

Use your calculator to complete the following chart and answer the questions.

6-2

Dates of Oil Change	Cost Of Materials: Tools	5 Quarts of Oil	Oil Filter	Cost Of Oil Change: Total if done by yourself	By a Service Station	Savings
1/18						
4/18						
7/18						
10/18						
1/18						
4/18						
7/18						
10/18						
				Total:	Total:	Total:

(1) Did you save or lose money on your first oil change ? _____
How much ? _____

(2) Did you include the cost of tools after the first oil change ? _____
Do you need to ? _____

(3) How many oil changes (after the first one) does it take to recover what you lost in the first oil change ? _____

(4) Over two years what is the average cost per oil change if you do it yourself ? _____ Average if done by a service station ? _____

(5) How much money would you save over two years ? _____

(6) At this rate, how much would you save in 4 years ? _____
6 years ? _____ 8 years ? _____

(7) After changing your own oil for 1 year, you are now an expert at it. You decide to change other people's oil on Saturdays. How much would you have to charge per oil change to make a 30 % profit ? _____
What would your profit be in dollars for one oil change ? _____

(8) How many oil changes would you have to do at 30 % profit to $ 25.00 ? _____ How many to make $ 40.00 ? _____

(9) Fill out another chart for your family's car. Check actual store prices or ads for the cost of the tools and supplies. Let your family know how much money you can save them by changing their oil.

Teacher Notes for The Calculator and McDonalds

PRIOR KNOWLEDGE NEEDED:

(1) Using Percents

(2) Rounding Decimals

OBJECTIVES:

(1) Given a McDonalds order blank and a list of food orders, the student will properly fill out the order form and calculate the total cost with and without tax.

(2) Given a calculator the student will accurately calculate the McDonalds bill.

(3) Given a calculator the student will compute the 4% sales tax on totals up to $30.00.

(4) The student will round off decimal values to the nearest cent.

MATERIALS:

(1) A copy of page 6-4 for each student, or make an overhead transparency. Better yet, make a large price sheet to post in the room.

(2) Several copies of page 6-5 (the order blanks) for each student. You may want to pick up some actual order blanks from your local McDonalds.

(3) An overhead transparency and a copy of page 6-6 for each student.

(4) A copy of pages 6-7 & 6-8 for each student.

(5) A calculator for each student.

For lesson one, pass out pages 6-6, 6-4 (unless page 6-4 is on the overhead or posted on the wall), and the calculators. Go over the order forms to familiarize the students with what McDonalds has on their menu. Note the X-large, the C, V, S with the shakes, the coffee with cream, and the bottom of the order blank if they do not wish to have the "works" on their burger. Stress carefully that the number of each item goes in the first column of the form and the total amount goes in the last column.

Show the students how to make out their own order forms using the calculator to find the total amount for each item purchased. Teacher can do it on the overhead as the students do it on page 6-6. Have the students use the calculators to find the total. Tax will be explained in lesson two. Now pass out page 6-7 and four order forms and have the students fill them out. You may need to do one or two problems more with some students before they can work on their own.

For lesson two, use the problems on page 6- 7 (after they have been corrected) to explain the 4% sales tax. A discussion of the tax (what materials are taxed and what the tax is used for) would be good at this time. Show the students how to use the calculator to find the tax. Review how to round decimals, and how to round money to the nearest cent. Find the tax on pages 6-6, 6-7 together. Pass out page 6-8 and four more order blanks. The students should figure tax in this assignment.

McDonalds Menu

Large French Fries	. 45
Small French Fries	. 30
Onion Rings	. 45
Hot Pie	. 25
McDonalds Cookies	. 20
Gift Certificates	. 50
Shakes vanilla, chocolate, strawberry	. 40
Artic Orange	. 40
Hot Chocolate	. 20
Coffee	. 20/. 25

McFeast	. 85
Quarter Pounder w/cheese	. 80
Quarter Pounder	. 65
Big Mac	. 75
Filet of Fish	. 55
Cheeseburger	. 35
Hamburger	. 30

	small	medium	large
Coca Cola	. 20	. 30	. 40
7 - Up (Sugar free)	. 20	. 30	. 40
Root Beer	. 20	. 30	. 40
Orange	. 20	. 30	. 40
Milk	. 20		

NO. OF	ITEMS	AMOUNT
	HAMBURGER	
	¼LB H'BURGER	
	CH'BURGER	
	¼LB CH'BURGER	
	FILET	
	BIG MAC	
	QLT	
	FRIES	
	X-LARGE	
	PIE	
	COOKIES	
	MUFFIN	
	EGG McMUFFIN	
	TR-RIPPLE	
	BEVERAGES	
C V S	SHAKES	
	COKE	
	X-LARGE	
	ORANGE	
	X-LARGE	
	ROOT BEER	
	X-LARGE	
	MILK	
	CF ☐ CR	
	LGE CF ☐ CR	
	HOT CHOC	

397878 SUB-TOTAL

THANK YOU PLEASE CALL AGAIN TAX

CODE 206 Trademarks Property of McDonald Corp Printed in U.S.A. TOTAL

☐ K M O Pi DBL ¼LB CB PL
☐ K M O Pi DBL ¼LB CB PL
☐ K M O Pi L T S CB QLT
☐ K M O Pi L T S CB QLT
☐ S L O Pi CH BIG MAC
☐ K TS CH PL FILET

397878 NAME _____

NO. OF	ITEMS	AMOUNT
	HAMBURGER	
	¼LB H'BURGER	
	CH'BURGER	
	¼LB CH'BURGER	
	FILET	
	BIG MAC	
	QLT	
	FRIES	
	X-LARGE	
	PIE	
	COOKIES	
	MUFFIN	
	EGG McMUFFIN	
	TR-RIPPLE	
	BEVERAGES	
C V S	SHAKES	
	COKE	
	X-LARGE	
	ORANGE	
	X-LARGE	
	ROOT BEER	
	X-LARGE	
	MILK	
	CF ☐ CR	
	LGE CF ☐ CR	
	HOT CHOC	

397878 SUB-TOTAL

THANK YOU PLEASE CALL AGAIN TAX

CODE 206 Trademarks Property of McDonald Corp Printed in U.S.A. TOTAL

☐ K M O Pi DBL ¼LB CB PL
☐ K M O Pi DBL ¼LB CB PL
☐ K M O Pi L T S CB QLT
☐ K M O Pi L T S CB QLT
☐ S L O Pi CH BIG MAC
☐ K TS CH PL FILET

397878 NAME _____

Be a Cashier at McDonalds

NO. OF	ITEMS	AMOUNT
	HAMBURGER	
	¼LB H'BURGER	
	CH'BURGER	
	¼LB CH'BURGER	
	FILET	
	BIG MAC	
	QLT	
	FRIES	
	X-LARGE	
	PIE	
	COOKIES	
	MUFFIN	
	EGG McMUFFIN	
	TR-RIPPLE	
	BEVERAGES	
C V S	SHAKES	
	COKE	
	X-LARGE	
	ORANGE	
	X-LARGE	
	ROOT BEER	
	X-LARGE	
	MILK	
	CF ☐ CR	
	LGE CF ☐ CR	
	HOT CHOC	
397878	SUB-TOTAL	
THANK YOU PLEASE CALL AGAIN	TAX	
COCE 206 Trademarks Property of McDonald's Corp Printed in U.S.A.	TOTAL	

☐ K M O Pi DBL ¼LB CB PL
☐ K M O Pi DBL ¼LB CB PL
☐ K M O Pi L T S CB QLT
☐ K M O Pi L T S CB QLT
☐ S L O Pi CH BIG MAC
☐ K TS CH PL FILET

397878 NAME_____

You have an afternoon job at McDonalds. Your first customer gave you the following order. Make out the order form and find the total. Do not figure the tax today.

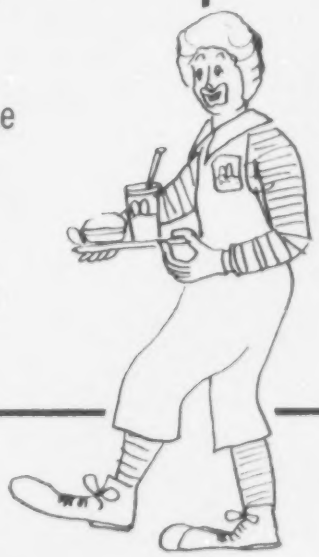
3 cheeseburgers
4 hamburgers
2 hot chocolates
2 cokes (1 of them large)
4 fries
1 coffee with cream
1 strawberry shake
1 chocolate shake

Your second day as a cashier at McDonalds

This is day # 2 of your job. Make out the order forms for the following orders:

2 hamburgers
2 cheeseburgers
1 quarter pounder w/ cheese
1 strawberry shake
2 cokes
2 large root beers

3 quarter pounders
4 hamburgers
4 french fries (2 of them large orders)
2 chocolate shakes
3 vanilla shakes
1 milk



3 milks
2 chocolate shakes
1 vanilla shake
3 fish filet
7 cheeseburgers
8 fries

2 cheeseburgers
3 hamburgers
2 quarter pounders
2 oranges
3 root beers
3 french fries
1 chocolate malt

Your third day as a cashier at McDonalds

This is day # 3 of your job. Make out the order forms for the following orders:

1 fish filet
4 large french fries
1 large orange drink
1 large coffee
3 quarter pounders
4 McFeasts
1 apple pie

3 milk
2 chocolate shakes
1 vanilla shake
2 7 - ups
3 hamburgers
3 Big Macs
2 McFeasts

4 hamburgers
2 quarter pounders w/ cheese
4 fries
2 chocolate shakes
3 vanilla shakes
1 milk

1 chocolate shake
1 vanilla shake
1 root beer
2 hamburgers
2 quarter pounders

Teacher Notes for Cigarette Smoking and Your Health

PRIOR KNOWLEDGE NEEDED:

(1) Using Percents
(2) Rounding decimals to the nearest tenth and the nearest whole number.

OBJECTIVES: Given a calculator the student will be able to:

(1) Calculate the numbers of smoking realted deaths in the U.S.
(2) Determine the number of years a smoker takes off his life.
(3) Calculate different cost figures related to the smoking phenomenon.

MATERIALS:

(1) A calculator for each student.
(2 Student Pages 7-1 to 7-4 duplicated for each student.

Little advance preparation by the teacher will be necessary to present this unit. Specific data or teaching concepts are noted below. The unit could be presented in one day, with little discussion and students simply performing the calculations. Or it could be extended to two or three days with the aid of materials available from the American Cancer Society or extensions of some of the calculations presented here. It is suggested that the teacher work through these exercises ahead of time for these possible extensions.

The American Cancer Society has a wealth of materials available to schools without cost. Films, filmstrips, and models are loaned gratis, usually for short periods. Pamphlets, folders, and posters are also available for distribution. In Minneapolis their office is located at 2750 Park Avenue (871-2111). It will be well worth the effort to call or stop by their office.

In question #4 under Smoking and Health an understanding of rounding decimal numbers to the nearest whole number is necessary.

In question #6 under Smoking and Health the teacher will need figures for the total number of boys and girls in your school.

For question #1 under the cost section, the teacher might want to quote the current vending machine or convenience store price or have the class decide on the most average price.

The questions under How Much Will Cigarettes Cost involve use of the constant function of the calculator. The teacher will want to familiarize students with this operation. The inflation figure must also be supplied. You could use the current figure or an average of the past several years.

Cigarette Smoking and Your Health

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

That small typed message on the side of a pack of cigarettes is most often ignored by smokers - both teen and adult. Besides the well-publicized link between smoking and lung cancer, many other things happen to the body every time the smoker takes a puff. Blood pressure goes up by ten to twenty points, the heart beats faster by twenty-five extra beats per minute, skin temperature drops, and eyesight dims. Inhaled smoke harms membranes of lips, tongue, palate, throat, and makes food taste funny. Also 90% of the smoke stays in the body - millions of chemical particles as noxious as car exhaust. Then there are the simple displeasures like morning cough, irritated eyes, stained teeth or fingers, and burns on favorite clothes. Besides lung cancer, smoking has also been shown to contribute to bronchitis, emphysema, cancer of the bladder, and heart and circulatory diseases. In addition, it has been shown that tobacco is harmful to the developing fetus in pregnant women. If all of these facts and arguments against smoking go in one ear and out the other, just take calculator in hand and look at some of the astounding numbers the smoking phenomenon has created.

Smoking and Health

1. Each year in the United States there are approximately 83,000 deaths from lung cancer. 80% of these deaths are caused by smoking. How many smokers die of lung cancer each year?

   _____

2. This year there will be 93,000 new cases of lung cancer discovered in the U.S. Unfortunately only about 1 in 20 cases, i.e. 5%, will be cured. Of these 93,000 cancer cases, how many will be cured?

   _____

3. Each year more than 600,000 Americans die of coronary heart disease. 30% of these deaths can be directly attributed to cigarette smoking. How many smokers die of heart disease each year?

   _____

4. "You've come a long way, baby!" Female death rates in 1966 were as low as 1/6 the death rates among males. Now they are 1/4 and threatening to catch up. Complete the table below to see this alarming increase.

   (Note: Round all decimals to the nearest whole number)

TOBACCO RELATED DISEASES	MALE DEATHS 1966	FEMALE DEATHS 1966	FEMALE DEATHS 1975
LUNG CANCER	41,012	x .16 = _____	x .25 = _____
OTHER CANCERS (LARNYX, BLADDER, ETC.)	28,045	x .16 = _____	x .25 = _____
CORONARY DISEASE	145,956	x .16 = _____	x .25 = _____
OTHER VASCULAR DISEASES (STROKES, ETC.)	42,821	x .16 = _____	x .25 = _____
ALL OTHER CAUSES (EMPHYSEMA, BRONCHITIS, ETC.)	43,726	x .16 = _____	x .25 = _____

5. It is estimated that each cigarette you smoke takes 10 minutes off your life.
(Note: Round all decimals to the nearest tenth.)

   a. How many cigarettes does a pack-a-day smoker smoke in one year? (20 cigarettes to a pack)

   _____

   b. How many minutes are lost after one year by a pack-a-day smoker?

   _____

   c. How many hours? _____

   d. How many days? _____

   e. After ten years of smoking a pack-a-day, now many years has the smoker lost?

   _____

6. In 1976 the percentage of all girls age 13 to 17 who smoke is 27%. The figure for boys who smoke is 30%. Assuming this percentage is correct for your school population, approximately how many girls in your school smoke?

   _____

   How many boys? _____

Note: According to a 1967 British government study of smoking habits, 85% of teenagers who smoke more than a single cigarette become regular dependent smokers. And only 1 in 4 smokers ever succeeds in becoming a permanent ex-smoker.

Just How Much Do Cigarettes Cost?

1. How much does a pack of cigarettes cost? _____

2. If you were to smoke (buy) a pack of cigarettes each day for an entire year, how much money would you spend on cigarettes?

   _____

   How much money would you spend on cigarettes over a period of 10 years? (Assuming they stayed at price quoted in #1)

   _____

   30 years? _____

3. In Minneapolis, there are 434,410 people. In the United States 36.2% of the total population smokes cigarettes. If you assume that this percentage is correct for Minneapolis, How many smokers are there in Minneapolis?

   _____

   If you assume that the average smoker smokes (buys) a pack of cigarettes a day, how much money do Minneapolis smokers spend each day on cigarettes?

   _____

   How much money is spent on cigarettes in Minneapolis over a period of 1 year?

   _____ 10 years? _____

4. The population of Minnesota is 3,805,069. Using the same percentage you used in problem number 3, compute the number of smokers in Minnesota. _____

   How much money is spent in Minnesota on cigarettes each day? _____

   How much money is spent in a year? _____ in 10 years? _____

5. The population of the United States is near 200,000,000. Do some calculations on money spent on cigarettes in the country.

How Much Will Cigarettes Cost?

If you assume the rate of inflation to be each year, what will a pack of cigarettes cost in 5 years? _____

What will a pack of cigarettes cost in 10 years? _____

Teacher Notes for Using the Calculator to Estimate Population

PRIOR KNOWLEDGE NEEDED:

(1) Rounding decimals to the nearest whole number

OBJECTIVES: Given a calculator the student will be able to:

(1) Estimate populations using a growth rate figure.

(2) Estimate populations using a growth factor.

(3) Estimate population density for Canada, Mexico, and the U.S.

(4) Estimate a population explosion.

MATERIALS:

(1) A calculator for each student.

(2) Student pages 7-5 to 7-12 for each student.

Working through this unit will involve two "side trips". The first shows how to use the constant key on your calculator, where the constant key is the equal sign key. Depending on the calcualtors used in the classroom, the teacher may not want to use this portion of the lesson. The second side trip shows how to deal with large numbers on your calculator. Although this lesson is necessary to complete the population unit, it should also prove very helpful for other examples where the calculator might overload.

Preparation for this unit might also include class discussion of what is meant by a population explosion and population density. Other factors to discuss might be the world food supply as it relates to a population explosion and zero population growth.

Using the Calculator to Estimate Population

Previous Year's Population + (Previous Year's Population × Growth Rate) → Estimated Population

EXAMPLE: Let's estimate the population for 1977 of Mini-apolis that has a population of 100 in 1976 and a growth rate = .04.

1976 Population		1976 Population		Growth Rate		Estimated 1977 Population
100	+	(100	x	.04)	=	104

Assume that Mini-apolis continues to grow at a rate of .04 and complete the table of estimated populations for 1978 - 1982.

Table 1 Year	Previous Year's Population	Previous Year's Population x Growth Rate	Estimated Population
1977	100	100 x .04 = 4	100 + 4 = 104
1978	104	104 x .04 = ___*	104 + ___ = ___
1979			
1980			
1981			
1982			

* Since these are whole people. . . round to the nearest whole number! ! ! ! ! ! !

Side Trip

Let's take a moment to learn how to use the constant key on your calculator.

	Press these keys	What appears
I.	C 1 0 X 2 =	
	C 2 0 X 2 =	
	C 4 0 X 2 =	
	C 8 0 X 2 =	
II.	C 1 0 X 2 =	
	X 2 =	
	X 2 =	
	X 2 =	
III.	C 1 0 X 2 =	
	=	
	=	
	=	

WHAT IS HAPPENING ? WHAT NUMBER DID YOU MULTIPLY BY EACH TIME ?

IF EACH METHOD OF MULTIPLYING BY A CONSTANT WORKS, WHICH IS FASTER?

WILL IT ALWAYS WORK ? TRY 1 0 0 X 3 = = =

5 X 10 = = =

1 0 0 X 1 . 0 2 = = =

Another Way to Use the Calculator to Estimate Population

Previous Year's Population **×** Growth Factor **→** Estimated Population

Growth Factor **=** 1 **+** Growth Rate

If Mini-apolis' population of 100 increases at a rate of .04 then its Growth Factor equals 1 + .04 = 1.04

Example: Let's estimate the population for 1977 of Mini-apolis using this new formula. Since the growth rate is .04, its Growth Factor is 1.04.

1976 Population		Growth Factor		1977 Estimated Population
100	X	1.04	=	104

Using the new formula complete Table 2, and compare these results with those in Table 1. (Can you use the constant key to do this quickly ?)

Population of Mini-apolis with a Growth Factor of 1.04

Table 2 Year	Previous Year's Population	Estimated Population
1977	100	104
1978		
1979		
1980		
1981		
1982		

Side Trip

Your calculator overloads when a number with >8 digits is entered. There are times when you will be working with numbers larger than 8 digits. That is why we should take a moment to learn how to rewrite large numbers so you can work with them on your calculator.

Try these problems on your calculator:

250,000,000 ÷ 5,000 = 50,000

300,000,000 ÷ 600 = 500,000

231,600,000 ÷ 300 = 772,000

999,800,000 ÷ 200 = 4,999,000

Can they be done as they are written ?_____

To do these problems on your calculator each 9 digit number and each divisor can be rewritten as follows:

250 million	÷	.005
300 million	÷	.0006
231.6 million	÷	.0003
999.8 million	÷	.0002

How many places to the left was the decimal point moved ?_____

This is the same as dividing by _____.

(Writing million after the number tells you that the true value of that number is a million times it.)

Let's use the calculator to do the original problems with the large numbers and the divisors rewritten.

[2] [5] [0] [÷] [·] [0] [0] [5] [=] _____

[3] [0] [0] [÷] [·] [0] [0] [0] [6] [=] _____

[2] [3] [1] [·] [6] [÷] [·] [0] [0] [0] [3] [=] _____

[9] [9] [9] [·] [8] [÷] [·] [0] [0] [0] [2] [=] _____

Are your answers the same as those given ?_____

When you rewrote the divisor you moved the decimal point

_____ places to the left.

When you rewrote the larger number you moved the decimal

point _____ places to the left.

Try these problems on your calculator.

(HINT: Rewrite the numbers below the original numbers.)

755,500,000 ÷ 50,000 =

_____ _____ = _____

324,000,000 ÷ 8,000 =

_____ _____ = _____

634,450,000 ÷ 75,000 =

_____ _____ = _____

What rule could you develop for rewriting large numbers to be used on the calculator ?

Using the Calculator to Estimate Population for CANADA , MEXICO and the UNITED STATES

Previous Year's Population ✕ Growth Factor ⟶ Estimated Population

EXAMPLE: Mini-apolis has a population of 100 in 1976 and a growth factor of 1.04 . . . . To estimate the population for future year's, enter 100 [X] 1.04 . . . . THEN . . . .

[=] ____ [=] ____ [=] ____ [=] ____ [=] ____ [=] ____

1977 1978 1979 1980 1981 1982

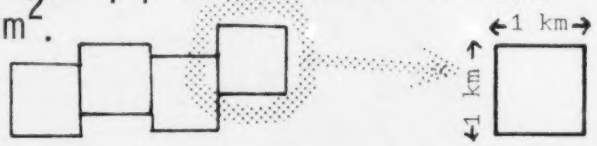
Use the above method to complete this population chart.

Year	CANADA Growth Factor = 1.013	MEXICO Growth Factor = 1.035	UNITED STATES Growth Factor = 1.008
1976	23.1 million	62.3 million	215.3 million
1977			
1978			
1979			
1980			
1981			
1982			

Using the Calculator to Estimate Population Density

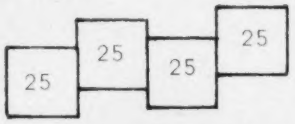
Population ÷ Land Area ➔ Density

EXAMPLE: In 1976 Mini-apolis has a population of 100. The area of Mini-apolis is 4 km^2.



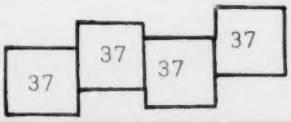
To determine how many people live in each km^2, calculate the density.

100 people ÷ 4 km^2 = 25 people in each km^2



If Mini-apolis continues to grow with a growth factor of 1.04, the estimated population for 1986 is 148. Mini-apolis is surrounded by water so the area will still be 4 km^2.

148 people ÷ 4 km^2 = 37 people in each km^2



Calculate the density for Canada, Mexico and the United States in the years 1976 and 1982. Since the population numbers are too large for the calculator rewrite them so they fit.

EXAMPLE: Canada 1976: 23.1 ÷ 9220974 = 0.0000025 x 1000000 = 2.5 people in each km^2

Year	CANADA Area = 9,220,974 km^2	MEXICO Area = 1,972,547 km^2	UNITED STATES Area = 9,160,412 km^2
1976			
1982			

Using the Calculator to Estimate a Population Explosion

You Will Need: 2 calculators
2 students

ACTIVITY: Have one student be "Mexico" and enter the 1976 population of Mexico in one calculator:

enter: 62.3 (million)

Have the other student be "United States" and enter the 1976 population of the United States in the other calculator:

enter: 215.3 (million)

Now have each country enter the growth factor for their country:

Mexico enters: [X] 1.035

United States enters: [X] 1.008

Both "countries" at the same time push the = button on their calculator while saying "1977". . . then = "1978". . . = "1979". . .

Players should watch the numbers on both calculators. Both continue to push = at the same time until the numbers on the calculator are "close to" equal.

In what year are the populations of Mexico and the United States "about" equal? _____

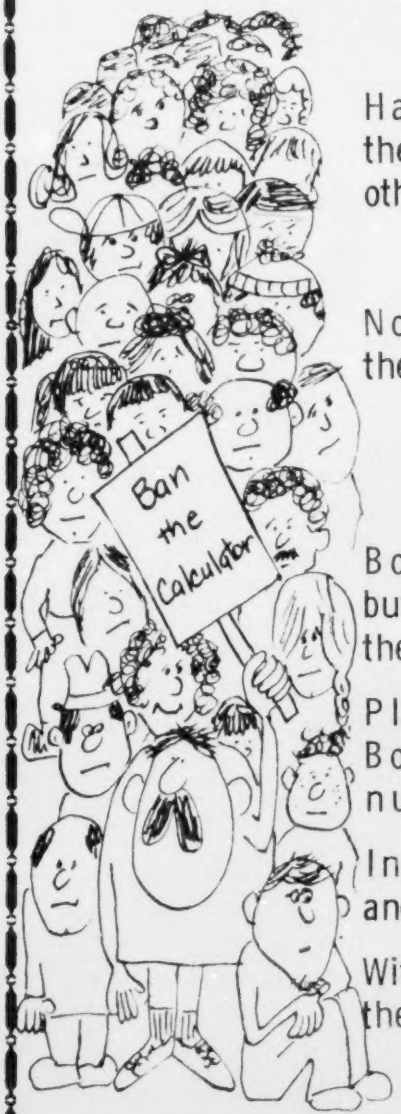
Without clearing the calculators, push [÷] and the land area for the country:

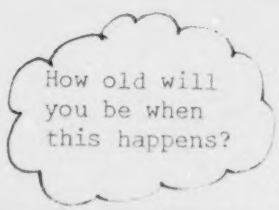
Mexico enters: [÷] 1972547

United States enters: [÷] 9160412

Now both countries enter [X] 1000000 [=]

How many people per km^2 in Mexico? _____
in the U.S.?





CALCULATOR INFORMATION RESOURCES

Boyle, Patrick J. "Calculator Charades." MATHEMATICS TEACHER 69 (April 1976): 281-82

The article gives 11 different DATOCRMPs (do the arithmetic and turn over the calculator to read the message problems). These could be used in a junior high class as attitude builders. Three of the examples require scientific calculators with $_{e}x$ and $_{y}x$ keys.

"Calculators," Consumer Reports 40 (September 1975): 533-541.
"Scientific Calculators," Consumer Reports 41 (February 1976): 86-87

Even though many of the models which were tested are no longer available, and all of the prices are out-dated, these articles are still useful, especially for someone developing criteria for calculator purchase.

If calculators must be classified according to function, CU's classification is satisfactory only for non-instructional purposes. For someone using calculators as instructional tools, other considerations are important. Their classification: (1) basic operation machine, (2) general purpose machine, (3) scientific machine.

CU considered the following features (and reported how each model performed): (1) ease of entry, (2) quality of display, (3) versatility of functions, (4) accuracy and keystroke count, (5) battery life.

In the 1975 article both general purpose and scientific calculators were reviewed (basic operation calculators were ignored) on the criteria listed above.

In the 1976 article it was recognized that scientific calculators must be judged on (at least in part) different criteria than general purpose calculators. Keystroke count was dropped as a criterion and calculating power was added. By "calculation/power" they mean "ability to handle algebraic expressions of varying complexity without using pencil/paper or memory keys.

For use in instruction at a particular level, other important additions and subtractions would need to be made which CU does not consider.

"Calculation or Computation?" Is that the Question?" Teacher 92 (March 1975): 52. (entire article)

There are 25,000,000 pocket calculators in this country and many of them are in classrooms, smuggled in by students who find them preferable to fingers for counting, or brought in by teachers who see them as a useful learning tool. There is hot argument between the pro-calculator educators and their opponents. The advocates point out that they permit students to become involved in mathematical operations that would otherwise be too time-consuming or seem too overwhelming, and they permit students to check their own work. The anti-calculator people worry that their use will destroy any hope that students will ever develop basic computational skills. The Berkely, California, school board has supplied 200 calculators as part of a remedial math program for junior high school students. On the other hand, 72% of the teachers polled by Mathematics Teacher Magazine opposed allowing seventh-graders to use calculators.

Cech, J. P. "The Effect of the Use of Desk Calculators on Attitude and Achievement with Low-Achieving Ninth Graders." MATHEMATICS TEACHERS 65 (February 1972): 183-86.

This report of Cech's dissertation conducted in 1969 (see Dissertation Abstracts Dec., 1970, page 2784-A). The calculator was used for 7 weeks in 5 grade 9 general mathematics classes as a checking device for paper and pencil computation problems. Students were pretested and posttested on computation skills and attitudes toward mathematics. Cech found no significant differences at the 5% level between the calculator and non-calculator groups. Also, he found no differences in attitudes toward mathematics, and he found that students could not compute better with the aid of a calculator than without one.

Cech did not use the calculator in a very interesting way and admits that "the calculator might be used effectively to illustrate some mathematical principles." All in all, the study was rather uninspired.

D'Aulaire, Emily and Ola, "Put a Computer in Your Pocket," Reader's Digest, September, 1975 pp 115-8.

This article is a nice public relations statement on the calculator, written for the average American non-mathematician; to help explain what calculators can do, how to operate, and what kind of impact they are having on our way of life. The D'aulaires give examples of people who use calculators to help figure food costs, gas mileage, balance checkbooks, and other everyday uses; as well more unusual ones, such as being used on a Mt.Everest expedition, and the Apollo-Soyuz linkup. The best part of the article is the clear explanation of how the calculator is designed, and how it is able to function with a "tiny space-age 'brain' no bigger than a baby's fingernail, no more expensive than a gallon of milk." The authors explain what the different keys do, what different kinds of models there are, and give examples of its ruggedness: (a calculator lost by a California survey crew on a 5000 ft. mountain, where summer temperatures soar above 100 degrees and winter brings 10 feet of snow, blinked instantly to life when found by a hunter a year and a half later.) The tone of the article is very positve and optimistic: "The calculator is spawning an electronics revolution that promises to benefit us for a long time to come."

Fehr, H. F., G. McMeen, and M. Sokol. "Using Hand-operated Computing Machines in Learning Arithmetic." ARITHMETIC TEACHER 3 (October 1956): 145-50

This is a 1955 report of a 4½ month study carried out on eight fifth grade classes. A statistical analysis was carried out on 25 pairs of students matched on IQ and pretest scores. The results indicated that the experimental (calculator) group gained significantly (5% level) over the control group in computation and reasoning ability.

While the calculating machines (hand operated Monroe Educator Models) were only used for checking answers of paper and pencil operations, the operation of the machines required a knowledge of the properties of addition, subtraction and multiplication of whole numbers. Thus, even though a calculator was used as a checking device (much as in the Cech study) the operation of the calculators may have forced the students to learn some of the details of whole number artithmetic.

Feldzamen, A. N. and Henle, F. THE CALCULATOR HANDBOOK, 1973. Berkeley Medallion Books, 200 Madison Ave., New York, NY 10016

This book provides a practical guide for the use of the calculator in everyday life. It is designed to meet the needs of the general public and for this purpose, it is by far the best publication known to be available (*though not readily) at this time.

The authors describe how to use any make or model of calculator to help with shopping, buying or selling stocks, calculating profits, evaluating savings, investments, travel expenses, etc., etc. There is even a section which deals with odds at the race track or gaming table. There are 28 chapters in the book. Each deals with a different use of the calculator and contains step by step directions of how to use the calculator efficiently and effectively.

The typical real life problem situations could be of great value to the classroom teacher. They provide a rich resource of practical applications and consumer situations with which everyone has to deal.

The book is recommended without reservation. A copy should be available to every teacher using the calculator as a teaching aid.

(*The book was difficult to obtain. Two large book stores (B. Dalton and Perrines) could not find it listed Books in Print. However, one can order it directly from Berkeley Medallion, cost $1.25. Delivery takes 3 to 4 weeks.)

Gaslin, William L. "A Comparison of Achievement and Attitudes of Students Using Convention or Calculator-Based Algorithms for Operations on Positive Rational Numbers in Ninth-Grade General Mathematics." JOURNAL FOR RESEARCH IN MATHEMATICS EDUCATION 6 (March 1975): 95-108.

This is a report of Gaslin's 1972 dissertation (see the Resource Center for a copy) which was conducted on 101 grade nine low ability students attending six classes in two different schools. Gaslin used three different treatments for performing operations on positive rational numbers. Treatment one was the usual approach to working with fractions, treatment two was the usual approach with the aid of the calculator and treatment three was an alternative algorithm set using the calculator (fractions were converted to decimals on the calculator).

Gaslin found that the alternative algorithm set was a viable alternative to the usual approach to working with fractions. He states that the alternative algorithm set "promoted superior performance when compared to the" conventional approaches on retention of skills in working with fractions. Also, he found that the alternative algorithm set was more efficient (in terms of rate of mastery) than the conventional approach.

Gibb, E. Glenadine. "My Child Wants A Calculator!" NCTM NEWSLETTER 12 (December 1975): 1.

A statment by the NCTM president on when the calculator should be introduced in the classroom (not until "the students have developed a concept of number, a system for naming numbers, and an understanding of the meaning and process of basic operations"). The calculator should be used to explore, compute, estimate, and increase skills in problem solving. A section on selecting a calculator is also included.

Gibb, E Glenadine. "Calculators In The Classroom," Today's Education 64. (November/December 1975): pp 42-44

Strongly recommended for any educator interested in the calculator's use in the classroom. She asks some interesting questions regarding the calculator and provides several suggestions as to how the calculator may be used. Also, included are suggestions for purchasing calculators and what to consider. She closes with a short, but useful bibliography.

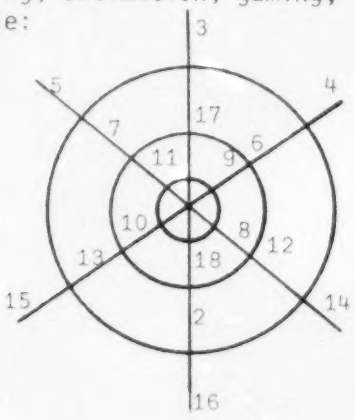
Hawthorne, Frank S. "Hand-Held Calculators: Help or Hindrance?" ARITHMETIC TEACHER 20 (December 1973): 671-72.

This article is a waste. According to him, calculators will "produce no grand changes in the elementary curriculum" and few changes in this curriculum will be necessary (he mentions an earlier introduction of decimals and negative numbers). Are there advantages to using calculators? Yes: (1) emphasis on checking answers provides immediate verification, which is important for motivation; (2) elimination of tedious, unnecessary calculations which destroy interest. Disadvantages? Probably yes--if calculators are introduced too early, it could hurt the understanding of basic number facts. Poor New York! Mr. Hawthorne is the State Mathematics Consultant. Oh, well, he wrote the article way back in '73.

Hoffman, Ruth I. "Don't Knock the Small Calculator--Use It!" INSTRUCTOR 85 (August/September 1975):149-50.

(You may have seen Ruth as the T.I T.V. star)

Hoffman argues for the use of calculators primarily at the elementary level for checking, estimation, gaming, reinforcing concepts, and pattern searches. For example:



Add up the #s along any circle or line. What do you notice? Could you create a similar magic circle?

She gives other worthwhile elementary applications.

Immerzeel, George. "It's 1986 and Every Student Has a Calculator." INSTRUCTOR 85 (April 1976): 47-51, 148.

This article is a must for elementary school math teachers. Also, any other math educator should profit from reading it. Basically, the article is a review of some of the ways Mr. Immerzeel has used the calculator in his classroom. He refers to the calculator as "a portable hand-held math lab providing a source of experiences with numbers in a fast, efficient manner." He gives many "hands-on" examples of interesting exercises, games and student-made-up-problems that could directly be used in the classroom. (I mean you could take theseright out of the article and use them). An increase in students motivation and more practical uses of (and problems involving) such concepts as area and volume are rather obvious consequences of the calculators in the classroom. A perhaps surprising consequence is an increase in problem solving skills (he gives no research to support this). The ability to solve problems is directly related to the number of problems solved and the calculator makes solving problems quicker (at about a 3 to 1 ratio). But more important is that problems can be related to real world experiences; neat examples: (1) what is the weight of $1 million in $1 bills? (they first have to do some work to find out the weight of a single $1 bill); (2) how high would the 17 billion McDonald hamburgers be if piled up? (again they first have to do some work to find out how thick a single hamburger is).
Some notable quotes:

"It has become obvious that it is more important to know when to multiply than how to multiply."
"At one time, people thought the calculator would decrease the student's use of mental arithmetic. It is interesting that just the opposite happens with teacher guidance."
"I can't help but wonder what the curriculum will be like in 1990 when every student can afford one of those new wrist-programmable computers."

(You(almost) have to read the article to appreciate that last quote.)

Immerzeel, George. "The Hand-Held Calculator" ARITHMETIC TEACHER 23 (April 1976): 230-231.

This article is an editorial and basically a summary of the article just reviewed above. "It is time for each teacher of mathematics to have a mini-calculator and it is time that we, as teachers of mathematics, find ways to use these amazing little devices to teach mathematics." We must prepare for the time (soon) when every student has a calculator.

National Advisory Committee on Mathematical Sciences (NACOME). OVERVIEW AND ANALYSIS OF SCHOOL MATHEMATICS K-12. Conference Board of Mathematical Sciences, 2100 Pennsylvania Ave., N.W., Suite 832, Washington, D.C. 20037

The National Advisory Committee on Mathematical Sciences, under the direction of the Conference Board of Mathematical Sciences, was established in May 1974 to prepare an overview and analysis of U.S. school-level mathematical education --its objectives, current practices and attainments. The committee published its comprehensive and extensive report in late 1975 with partial funding from the National Science Foundation.

The report is organized into six chapters:

1. Mathematics Curriculum Reform 1955-1973
2. Current Programs and Issues
3. Patterns of Instruction
4. Teacher Education
5. Evaluation
6. Recommendations and Perspectives

Additionally, the report includes a useful listing of acronyms and an excellent bibliography. Each chapter concludes with brief summary which succinctly highlights the issues and findings discussed in that chapter.

It is the opinion of this reviewer that anyone interested in mathematics education-parent, student, teacher, administrator -- would find the report most worthwhile reading. Further, every mathematics teacher should, by all means, be familiar with the issues raised and the content presented in this report.

For example,
item e, under Recommendation #3 states "that beginning no later than the end of the eighth grade, a calculator should be available for each mathematics student during each mathematics class. Each student should be permitted to use the calculator during all of his or her mathematical work including tests."

"Now--There's a Personal Calculator for Every Purse and Purpose." Popular Science 206 (February 1975): pp 78-81, 136.

This is a discussion of the physical attributes of calculators that were available before February 1975, (size, weight, keys and special features). Very useful for anyone interested in buying a calculator with a specific purpose in mind, but is probably a bit out of datein that it is 2 years old.

Pendleton, Dee dee. "Calculators in the Classroom." SCIENCE NEWS 107 (15 March 1975): 175-81.

Some arguments for an against the calculator are given.
Pros: "Estimation," use of large #'s, solving practical problems, measurement.
Not many specific examples were given.

Cons: (Some real goodies here!).
Calculators consume too much energy!!!
Basic arithmetic skills will not be acquired.

"Reader's Dialogue." Arithmetic Teacher 22 (December 1975) pp 658-660.

These 2 letters to the editor respond to an article written by Lowell Stultz, (AT, Feb.1975). Both stress the importance of noting the different types of keying sequences on calculator - arithmetic logic and algebraic logic. The use of the algebraic logic would be more beneficial to students in the lower grades in that students would not run into any difficulty with the difference in a written example and the use of a calculator. Ex.

arithmetic logic: [8] [±] [2] [±] [10]

algebraic logic: [8] [+] [2] [=] [10]

Rogers, James T. THE CALCULATING BOOK: FUN AND GAMES WITH YOUR POCKET CALCULATOR. 1975 Random House, 201 E. Fiftieth St., New York, NY 10022

This 80 page ($2.95) paper back book (booklet?) presents a hodge-podge of calculator activities in the "push these keys to see what happens" manner. No mention is made of any mathematical properties or concepts involved. The activities are definitely written for the non-math reader.

It might be possible to adapt and expand some of the patterns, games, puzzles or tricks for classroom use, but one questions whether the effort involved would be worthwhile. All of the activities can be found in more useable form in other publications.

The auther, a newspaperman, presently serves as member of the Board of Editors of Scientific American. The writing style is clever, and the activities are presented in, perhaps, a too "cute" manner.

Schlossberg, Edwin and Brockman, Joh, The Pocket Calculator Game Book, William Morrow and Co., 1975. ($3.95)

"The rule book for new authentic games you can play with your electronic marvel." The authors claim to have written this book to provide us with interesting, exciting, and amusing experiences, and to create new contexts for game playing. I think they have succeeded. Some of the games they describe require other materials: a deck of cards, dice, chips, or pencil and paper. Many of the games are excellent, and some help to reinforce concepts like odd and even, or place value; and some help reinforce skills such as estimation. Almost all involve discovering a strategy to win the game. I really enjoyed trying out a few of them. It seems like the authors must have had a good time thinking them up too.

Skoll, Pearl A. COPING WITH THE CALCULATOR. 1975. The author, 18735 Mayall St., Northridge, CA 90048

It was not possible to obtain a copy of this book. It is not listed in Books In Print. A personal note was sent to the author on November 2, 1976 (along with a $5.00 check) requesting a copy be mailed immediately. There has been no response.

Van Atta, Frank. "Calculators in the Classroom." ARITHMETIC TEACHER 14 (December 1967): 650-52

1. Introduction of the laws of exponents-- I believe this is not necessarily a good place to use calculators since most of the computations can easily be done by hand.(e.g. compare 2^3, 2^2, 2^5)
2. Measurement - (Good suggestion) Discover the Phythagorean Theorem by constructing 's an even no. of millimeters long and measuring the sides and tabulating results.
3. (An answer to Mirocha"s worries about "irrationality") Search for $\sqrt{2}$ on your calculator. Do you ever get 2 when you square? If you fill up your disply would adding an additional digit give 2 after squaring? Use the calculator to motivate the concept of irrational number.
4. Investigate fractional exponents e.g. $10^{.54}$. (Good idea for a lesson)

Vine, James, BOGGLE: Calculator Word/Number Games. Price, Stern, Sloan Publishers, 1975. ($1.95)

BOGGLE is a nice introduction to the art of calc-o-grams. These are words made from numbers when the calculator display is turned upside down. The elementary alphabet of B, E, H, I, L, O, S, which comes from the numerals 8, 3, 4, 1, 7, 0 and 5; can be used to make an amazing collection of words. The book is mostly comprised of stories that tell you to perform various operations on specified numbers, so that the final answer, when inverted, provides the punchline to a joke or the answer to a riddle. I like the idea of calc-o-gram stories, but I have a criticism of this collection: the author uses operations without any meaning. Instead of implying what operation to use, you are given a clue (m means multiphy, A means add, etc. Example: 2 women's clubs went to a concert and shared (D) 25 minutes listening to an off tune tenor. When he finished, there was a loud _____. 2 ÷ 25 = 0.08 = BOO) I think the book could be improved if you had to figure out what operation to use by the use of words and the context in which they are used. Otherwise, this is a nice source of words to invent stories for, and stories to use and/or adapt.